6 Research, Inventory, and Monitoring Needs

6.1 Introduction

The Division has supported a wide variety of watershed research, through access to its properties, directed management activities, and/or limited direct funding. Some of this research has primarily benefited the researcher, but the vast majority has also informed MDC managers and improved or supported watershed management practices. While the research budget at MDC is not constant, the value of contiguous, undeveloped watershed properties generally behind secure gates or patrolled on a regular basis has attracted many researchers who otherwise have their own funding. In addition, watershed properties have provided fertile backdrops for a wide range of graduate theses.

Listed below are a variety of research, inventory, or monitoring needs in the general areas of forests and forestry, wildlife, and cultural resources. These are listed in part to direct the Division's own efforts in the coming decade, but also as a specific reference for potential researchers who are looking for a project that would address a real need of the Division.

6.2 Forest Research Needs

1. ***Monitoring of Forest Management Activities:*** The MDC/DWM policy of "no measurable impact upon stream water quality from forest management activities" creates a need to establish a standard approach to measuring compliance. Streams should be monitored to correlate short-term water quality changes and active logging conducted on MDC lands within MDC/DWM standards. Monitoring should involve upstream and downstream and/or paired watershed sampling before planned operations, during active logging, and following the completion of the operations. The study should focus on storm event testing. Parameters should include pH, temperature, dissolved oxygen, turbidity, suspended solids, total particulates, total and fecal coliform, and nutrients. Based on this fieldwork, specific recommendations could be made outlining a low cost, statistically valid method of monitoring logging operations on a more wide-scale basis. Recommendations for adjustments in current MDC Conservation Management Practices would be made if necessary, based on this research.

2. ***Analysis of Optimal Riparian Vegetation:*** While the opportunity to shift species composition on the watersheds is limited by site, seed, overstory conditions, etc., it would be valuable to complete an investigative literature review to determine the water quality benefits/detriments associated with each of the common tree/shrub species. While species selection for an entire watershed should be based primarily on site suitability and species stability, in areas directly adjacent to tributaries and reservoir shorelines, a species' direct impact on water quality may have a measurable benefit. One result of this would be to generate a model of the ideal riparian forest for various sites. Models developed recently to quantify the buffering effects of riparian forest should be examined for applicability to Wachusett's forest.

3. ***Shoreline Vegetation Practices and Shoreline Hedge Effects:*** A great deal of time and effort has gone into the establishment and maintenance of the arborvitae shoreline hedge (see section 5.3.2). It would be useful to quantify the water quality benefits of this feature. Would there be water quality effects if the shoreline were allowed to revegetate to trees? Does the hedge actually provide significant water quality protection, per its original design?

4. ***Invasive Plant Species:*** A wide variety of invasive plant species is currently established on and adjacent to MDC properties on the Wachusett watershed. Control of these species is important to the establishment of tree regeneration and the maintenance of native plant diversity. To begin to address this issue, a survey of invasive plant species on the watershed and the extent of their spread should be conducted and added to the MDC GIS, in part to establish an historical reference point for future distribution of these species. Once priorities have been established for control, further research needs to be conducted on the feasibility of mechanical controls and/or the relative benefits and threats associated with chemical or biological controls. See section 5.4.6 of this plan for further discussion of this issue.

5. ***Evaluation of Wachusett Access Roads:*** Given that roads are a potential source of pollution and sedimentation on MDC lands, a systematic evaluation of the Wachusett road system would be valuable. This project would include a watershed-wide mapping of road conditions to identify trouble spots including testing for sediment transport during storm events. Part of this project would involve locating the most appropriate model for sizing culverts and utilizing GIS to routinely size culverts and design roads that will withstand 50-year storms. The results of this study would be useful in the decision making process when planning new road construction on newly acquired property as well as improving the current road network.

6. ***GIS Projects:*** The use of GIS technologies in the management of the natural resources of the Wachusett watershed is in its infancy. The potential for future use is immense. Essentially every component of the Division's management efforts could utilize the analytical and mapping capabilities of this technology. There is a need to either establish contracts to generate GIS data, or to increase the capabilities of the current MDC in-house GIS capability.

7. ***Aerial Photography:*** The aerial photography and resulting orthophotographs from 1992-1993 have proven to be invaluable. A wide variety of datalayers based on these images have been and continue to be generated. However, this information becomes more outdated with time. To ensure that the Division is making decisions based on as accurate and up to date information as possible requires the regular collection and processing of aerial digital image information. Ideally, this will occur mid-way through each ten-year management period. The data that this will provide is useful not only because it will be up to date, but because it will allow the tracking of changes through time of a wide range of variables of interest to Division personnel.

8. ***Hemlock WoollyAdelgid Monitoring and Impacts:*** The recent invasion of the hemlock woolly adelgid into the Wachusett forest has generated wide-ranging discussion regarding the future of the eastern hemlock around the reservoir. The potential impacts to water quality and the forest ecosystem and what we should be doing in the face of these impacts are difficult puzzles. A long-term study is needed to track the extent of the invasion and infestation and monitor the impacts with an emphasis on water quality. This study could also monitor the effects of the salvage of dead and dying hemlock and therefore help inform future management decisions.

6.3 Wildlife Research Needs

Only limited wildlife research or monitoring has been conducted on the Wachusett watershed in recent years. Some monitoring of high priority species has occurred, but limited resources and personnel have prevented extensive monitoring efforts. The following projects represent a few areas where technical data would assist in managing wildlife resources more effectively.

1. ***Movements and Feeding Behavior of Ring-billed and Herring Gulls in Central Massachusetts:*** Gulls continue to be the species of greatest concern with regard to water quality. Although efforts to disperse and move gulls have been very successful, long-range control must be focussed on controlling food resources. Gulls are able to travel great distances and utilize obscure food resources. For the most part, it is unclear where and how gulls at Wachusett Reservoir are finding and obtaining food. This research would enable the Division to identify and control alternative food sources as well as provide information on seasonal roosting behavior.

2. ***Population Dynamics and Dispersal in a Suburban Beaver Population with Limited Trapping:*** Beaver are considered another high priority species. Since the passing of Question 1 in 1996, there has been effectively no trapping mortality on beaver in the Wachusett watershed. Even if Question 1 were modified, there are very few trappers left in the state. Wachusett reservoir probably serves as a natural deterrent to dispersing beaver, however increasing populations may change this. By determining the population dynamics and dispersal of beaver in the watershed, a better understanding can be gained of what role marginal habitat will play in populations with little mortality.

3. ***Biological Surveys and Inventories:*** In order to minimize or avoid negative impacts of land management activities on wildlife and critical habitats, all proposed activities are reviewed by the MDC/DWM wildlife biologist. However, a single biologist is responsible for all 4 watersheds within the Division, and it would be impossible to physically inspect the hundreds of acres affected by these proposed activities. The Division must rely on records of known occurrences of critical habitat or species. Although new information is added as it becomes available, the database is far from complete. Biological surveys conducted by qualified persons can provide critical additional information that will aid MDC efforts to protect these resources during land management activities. Information should also be incorporated into GIS datalayers.

T. Kyker-Snowman

Wood turtle

4. ***Vernal Pool Surveys:*** To date, no formal surveys have been done to locate vernal pools on the Wachusett watershed. Vernal pool locations are recorded opportunistically by Division personnel in the field. The Division recently completed a contract that mapped *potential* vernal pools on the watershed using color infrared photos. Over 300 potential pools were identified in the watershed. These pools need to be surveyed to determine their status and perhaps locate other unmapped pools as well. This mapping will be incorporated into GIS to facilitate land management planning.

5. ***Routine Monitoring Activities:*** Routine monitoring programs for selective species will continue during this management period. These surveys include biannual surveys for beaver and muskrat within the reservoir, monitoring Common loon nesting around the watershed, Canada goose breeding surveys, and occasional breeding bird surveys. Other surveys (permanent breeding bird surveys, locating rare and endangered species) may be conducted if resources and personnel are available.

6.4 Cultural Resources Research Needs

The principal research need for the continued protection of cultural resources within MDC properties on the Wachusett Reservoir watershed is to inventory, accurately map, and digitize all known historic cultural sites. This inventory would be modeled after the multi-phased historic site inventory that was completed for the Quabbin Reservoir watershed in 1995-96. The Quabbin inventory was completed by graduate students and faculty of the Boston University Department of Archaeology in collaboration with the MDC staff archaeologist. The process involved integration of locational and descriptive information from a variety of cartographic and historical resources, including MDC Real Estate Plans and a series of maps dating as far back as 1794. Information from these sources was used to complete a database and map record for several hundred sites. Many of these sites were subsequently field checked for current condition. Locational information is entered in MDC's GIS so that important sites can be identified when management activities are proposed for areas within MDC's properties. This process greatly enhances the ability of managers to protect historic cultural resources.